VISITOR RESPONSES TO THE POSSIBLE RECESSION OF EXIT GLACIER AT KENAI FJORDS NATIONAL PARK

by

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STATEMENT OF THESIS APPROVAL

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ABSTRACT

Glaciers have been retreating since the end of the little ice age, and their retreat has increased dramatically since the 1980s. Some of the glaciers that are retreating are within national parks and are main visitor attractions. For example, visitors come from around the United States to experience Exit Glacier at Kenai Fjords National Park (KEFJ) and due to its accessibility, Exit Glacier provides a unique experience for visitors to easily approach and view a glacier. Exit Glacier has, however, been retreating, decreasing in volume, and continuing to move away from the original trail that initially led park visitors to the glacier. This study investigated this phenomenon with the purpose to understand how Exit Glacier's potential continued retreat might influence visitor behavior, experiences, and preferences. The researcher used onsite quantitative questionnaires (n = 539) and computer-altered photographs of potential glacier recession (n = 10) to identify visitor responses to Exit Glacier's retreat. The results indicate that visitors found current conditions moderately acceptable and found extreme recession primarily unacceptable. Visitors were most likely to be displaced during extreme recession and as visitors' beliefs in climate change increased their acceptability of recession conditions decreased.

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CHAPTER I

INTRODUCTION

Thesis Format

Because this thesis is written in an article format, there are three chapters. Chapter 1 is an introduction to the thesis, which provides the overall significance of the research and an introduction to the literature. Chapter 2 is a journal article that is prepared for submission to *Environmental Management*. Chapter 2 includes the major portions of the research, including the literature review, the research questions, results, and discussion. Chapter 3 provides understanding and insights I gained throughout the process of the thesis research. Chapter 3 includes the challenges, successes, and discoveries that have been a part of this research, as well as advice to fellow students and researchers.

Overall Significance

Glacial recession influences many aspects of natural resource management. This thesis aimed to understand how the possible retreat of Exit Glacier at Kenai Fjords National Park (KEFJ) may influence the quality of the visitor experience, visitor behavior, and visitor preferences. This is important for managers because part of the mission of the National Park Service is to create a place for visitors to have "enjoyment, education, and inspiration" (NPS Website). Consequently, understanding visitors'

perceptions is vital to effective management (Manning, 2011). Park managers also have to make challenging decisions about what to allow in a park, from research, to social events, to infrastructure (Dilsaver, 2000). Understanding visitors and their preferences aids in these decision-making processes (Manning, 2011). This research may not only help managers at KEFJ, but many methods and findings may be transferable to similar locations.

Previous research in human dimensions of climate change indicated Exit Glacier provides a relatively high-quality experience for visitors (Brownlee et al., 2013). Swanson, Vande Kamp, & Johnson (2003) found that less than .5% of visitors reported a negative experience at Exit Glacier. Visitors also reported that being able to 'see' and 'touch' the glacier were important to their enjoyment and satisfaction during their visit (Vande Kamp et al., 2004). Visitors who have a quality experience with a climate-sensitive resource are more likely to be aware of climate change impacts at a park (Brownlee et al., 2013). However, with the high potential of Exit Glacier's continued retreat, this study sought to determine potential changes in visitor behavior due to possible Exit Glacier recession, as well as how recession relates to their perception of climate change. Understanding perceptions of climate change may also deepen understandings of what influences visitor experiences and preferences.

Not only may the recession of Exit Glacier change the visitor experience, it may also change visitor behaviors. It is vital for managers to understand at what point of possible retreat visitors will no longer visit this portion of the park, or continue to visit but change behaviors (e.g., not getting out of the car, or only going to the nature center). Understanding visitor behaviors can help managers plan and allocate resources in a park

(Manning, 2011), particularly under uncertain futures. If managers have an understanding of how perceptions of climate change influence visitor preferences, behaviors, and experiences, they could better understand the visiting audience and possibly create visitor-centered interpretation.

In order to plan for and potentially mitigate a change in visitor behavior (e.g., not visiting Exit Glacier), managers can benefit from understanding visitor preferences (Driver & Brown, 1978). Although managers cannot slow a retreating glacier, they can implement adaptive strategies by planning for 'possible futures' that include potential visitor responses. For example, areas that have had dramatic change in New Zealand due to glacial retreat have used adaptive management strategies to provide quality experiences for visitors, such as modifying viewing areas (Purdie, 2013). Managers can benefit from understanding what alternative options visitors may prefer as the glacier retreats, which was also included in this study.

Overall Research Question

The overall research question for this thesis was, "On average, at what level of possible glacial retreat (e.g., decrease in Exit Glacier volume and terminus location) and decreased proximity (e.g., access or ability to get close to Exit Glacier) do visitors report change in experiences, preferences, and behaviors?" Also investigated in this study is how visitors' beliefs in climate change influence their response to the previous question.

CHAPTER II

VISITORS' NORMATIVE EVALUATIONS OF GLACIAL RECESSION AT KENAI FJORDS NATIONAL PARK

Abstract

Glaciers have been retreating since the end of the little ice age, and their retreat has increased dramatically since the 1980s. Some of the glaciers that are retreating are within national parks and are main visitor attractions. For example, visitors come from around the United States to experience Exit Glacier at Kenai Fjords National Park (KEFJ) and due to its accessibility, Exit Glacier provides a unique experience for visitors to easily approach and view a glacier. Exit Glacier has, however, been retreating, decreasing in volume, and continuing to move away from the original trail that initially led park visitors to the glacier. This study investigated this phenomenon with the purpose to understand how Exit Glacier's potential continued retreat might influence visitor behavior, experiences, and preferences. The researcher used onsite quantitative questionnaires (n = 539) and computer-altered photographs of potential glacier recession (n = 10) to identify visitor responses to Exit Glacier's retreat. The results indicate that visitors found current conditions moderately acceptable and found extreme recession primarily unacceptable. Visitors were most likely to be displaced during extreme

recession, and as visitors' beliefs in climate change increased, their acceptance of recession conditions decreased.

Introduction

Glaciers have been retreating since the end of the little ice age, and their retreat has increased dramatically since the 1980s (WGMS, 2008). Fueled by climate change, this retreat of glaciers has been worldwide, and often more rapid than expected (Houghton, 1996). Glaciers retreating worldwide have an influence on people in many different ways, including their ability to meet personal needs such as access to water resources, productive farming, and recreation, (Li, K., Li, Z., Gao, & Wang, 2011; Oppenheimer, 2012; Tacoli, 2009). Glacier retreat is important to be aware of, not only because of the proactive planning that can occur when influences of retreat are understood, but also because it can be an important indicator of climate change (WGMS, 2011).

Some of the glaciers that are retreating are within national parks (Brownlee, Hallo, Wright, Moore, & Powell, 2013; Hall & Fagre, 2003; Scott, Jones, & Konopek, 2006). Alaska in particular is a climate-sensitive region, and the national parks and other protected areas within Alaska are experiencing rapid resource-alteration due to climate change (NPS, Alaska Region, 2014). The resources that are being altered certainly include glaciers, which are a main visitor attraction, especially at Kenai Fjords National Park (Brownlee et al., 2013; Vande Kamp et al., 2004).

This study focuses specifically on Kenai Fjords National Park (KEFJ), which preserves the scenic and environmental integrity of an interconnected icefield, glacier,

and coastal fjord system" (NPS DOI, 2009, p.7). The Park's purpose, combined with the impacts of climate change at the Park, creates a challenging management environment for KEFJ professionals. As a park that is striving to preserve the scenic and environmental integrity of an icefield and glaciers, major challenges exist for future planning. KEFJ professionals cannot stop the retreat of the glaciers within the park or even predict the rate of retreat with exact certainty; however, they can and will need to manage for the change created by retreating glaciers. Managers will also need to plan for the potential changing visitor experience, a result of possible continued glacier retreat. For example, in the past KEFJ has responded to Exit Glacier's recession by extending the Exit Glacier trail.

The glacier of interest in this study is Exit Glacier, which is an outflow from the Harding Icefield and KEFJ's most accessible terrestrial glacier to Park visitors (Vande Kamp et al., 2004). Due to its accessibility, Exit Glacier is a main attraction for KEFJ visitors, and the Park has been extending the glacier access trail due to the glacier's retreat (Vande Kamp et al., 2004). The Park also has created glacier viewing locations in this area, but because of the continued retreat there has been increasing vegetation, which has obstructed views and potentially decreased viewing quality. The trail cannot be extended any further due to the moraine walls creating an unsafe environment for visitors, which may affect the quality of the visitor experience as well as visitor behavior, preferences, and overall use distributions, temporally and spatially.

This potential change to the visitor experience at Exit Glacier is a manifestation of the impact of climate change. Visitors' perceptions are a major factor in what can change a visitor experience. Visitor perceptions of climate change have been researched in many

disciplines (Brownlee et al., 2013; Gardner & Stern, 2002). Because glaciers are an indicator of climate change, understanding how perceptions of climate change may influence visitor behaviors, experiences, and preferences can be useful to park managers (Brownlee & Leong, 2011).

Therefore, the purpose of this study was to understand the likely visitor response to the possible continued retreat of Exit Glacier. Specifically, this study produced information to help KEFJ managers understand how Exit Glacier's possible continued retreat may influence visitor behavior, experiences, and preferences. Additionally this study also evaluated KEFJ visitors' perceptions of climate change and how those perceptions influence their experiences, behaviors, and preferences in relation to possible glacial retreat at KEFJ. This is important because it is vital to understand the visitor response in order to make informed management decisions and provide a positive and high-quality experience for visitors (Manning, 2011).

Literature Review

This literature review aims to provide background regarding the study context and the formulation of the research questions. It begins by addressing the global human responses to climate change, and includes how climate change, and in particular glacial recession, has influenced human behavior such as water acquisition and management (Li. K. et al., 2001), farming techniques (Morton, 2007), migration (Oppenheimer, 2012; Tacoli, 2009), and recreation (Baron et al., 2009; Hall & Farge, 2003; Orlove, 2010; Richardson & Loomis, 2004; Scott et al., 2006). The review then narrows to focus on how climate change and glacial recession have influenced visitation to protected areas,

including the number of visitors (Richardson & Loomis, 2004; Scott, et al., 2006) as well as peak visitation (Buckley & Foushee, 2012). Management strategies and management responses to changing climate and glacial recession are then covered. Finally, the approach employed in this study is reviewed, which is the Normative Approach with visual methods (Manning, 2011; Vaske, Shelby, Graefe, & Heberlein, 1986).

Glacial Recession and Human Behavior

Climate change influences human behavior around the world (Li, K., et al., 2011; Morton, 2007; Oppenheimer, 2012; Sharp et al., 2014; Tacoli, 2009), often by altering resource availability. For example, somewhere between 50% (Liniger, Weingartner, & Grosjean, 1998) and 75% of the world's fresh water comes from glaciers (Houghton, 1996), and therefore glacier retreat has an influence on water resources and availability. A study conducted in eastern Xinjiang, China demonstrated that glacial retreat created a shortage of water in the eastern Xinjiang Basin and in the city of Urumqi, which limits not only domestic water use, but also sustainable economic development (Li, K., et al., 2011).

Beyond development, a loss of water due to a changing climate and glacial recession influences farming practices, and smallholder and subsistence farmers suffer the most (Morton, 2007). The impacts are locally specific and difficult to predict (Altschuler & Brownlee, 2015). Factors that make farms more vulnerable to negative effects of climate change include being small in size, having low technology, and low capitalization (Morton, 2007). Factors that can increase farmers' resiliency include:

Family labor, diverse incomes in addition to agriculture, and indigenous knowledge (Morton, 2007).

Not only can climate change influence water resources and farming practices, a person's place of residence may also change. For example, in response to a changing climate, humans migrate (Oppenheimer, 2012), but it is unclear how *much* migration may occur and exactly *how* that migration will occur (Tacoli, 2009).

Beyond human migration, other activities, such as outdoor recreation, are also influenced by climate change (Sharp et al., 2014). For example, there are many ski resorts that have to adapt to a changing climate using adaptive strategies, such as moving ski runs to higher elevation, or producing their own snow (Orlove, 2010). A ski resort in Bolivia was abandoned because the slopes were located on a glacier that retreated beyond resort boundaries (Orlove, 2010). Many ski resorts round the world have runs positioned on glaciers, making them at risk for losing ski terrain (Orlove, 2010).

Alternatively, a coastal study demonstrated that projected impacts from climate change might influence outdoor recreation behavior in a different way. Specifically, it is likely that higher temperatures may increase visitation and concurrently raise sea levels, which will reduce the width of the beach (Coombes, Jones, & Sutherland, 2009). An increased number of visitors with decreased area of usable beach could create crowding issues (e.g., Manning, 2007). Water resources, migration, farming, and recreation are just some of the ways that climate change and glacial recession influence people and activities. Climate change is also influencing resources that are within protected areas, such as national parks (Baron et al., 2009; Hall & Farge, 2003; Richardson & Loomis, 2004; Scott et al., 2006).

Visitor Responses to Climate Change and Glacial Recession

Climate change has the capacity to influence current and future visitation to protected areas (Richardson & Loomis, 2004; Scott, et al., 2006). One of the major findings within visitor responses to a changing climate is that with increased temperatures and longer warm seasons, visitation to parks may increase (Richardson & Loomis, 2004; Scott, et al., 2006). For example, Richardson and Loomis (2004) found that with increasing temperatures, visitation to Rocky Mountain National Park (U.S.A.) is likely to increase. Not only does temperature influence visitation levels, but also the notion that the resources currently visited may no longer be present can drive visitation to these resources that are depleting, a phenomenon known as 'last chance tourism' (Lemelin, 2009). As one example, Scott, Jones, & Konopek (2006) found that visitation to Waterton Lakes National Park (Canada), was likely to increase in the short term (due to 'last chance' influence) and decrease in the longer term (due to depleted resources).

The projections made at Waterton Lakes National Park must be interpreted with caution because researchers projected future behaviors from current visitors, however in the long term those visitors may not be the same people visiting the park (Scott et al., 2006). Gardner and Stern (2002) refer to this concept as 'shifting baselines' and indicate that individual and collective standards (i.e., 'norms') may or may not change over time (Manning, 2011).

Although norms may change over time, research suggests that generally norms are temporally fairly stable (Bacon, Manning, Johnson, & Kamp, 2001; Kim & Shelby, 2008; Valliere & Manning, 2010). For example, although a study completed at Apostle Island National Lakeshore demonstrated that norms changed over time, there was also a

shift in the visitor type explaining why a change in norms occurred (Kuentzel & Heberlein, 2003). Conversely, research conducted over 22 years suggested that crowding norms at Denali National Park (Alaska) were relatively stable (Bacon et al., 2001). A study with similar results was conducted at Alcatraz Island (U.S.A.) which showed that crowding norms remained very similar between 1998 and 2007 (Valliere & Manning, 2010), and at Jirisan National Park (South Korea) crowding norms were also found to be relatively stable between 1993 and 2003 (Kim & Shelby, 2008). Some factors that may contribute to the stability are consistent visitor type, unwavering management objectives, and well-defined visitor opportunities (Bacon et al., 2001).

Related, past studies conducted at KEFJ identify a consistent visitor type over the last decade. For example, Brownlee and co-workers (2014) found a similar visitor type to a study conducted in 2003 (Vande Kamp & Johnson), with the following similarities: Two thirds of visitors had at least a college degree, the majority of visitors were Caucasian, samples were equally distributed across gender, and the majority of visitors lived within the United States (Brownlee et al., 2014; Swanson et al., 2003).

Although norms can remain stable over time, this study used two factors that are unknown: future human behavior and future glacial recession. Therefore, this study was not attempting to predict the future in either category and instead aimed to simply provide insight into one of several possible futures for Exit Glacier. This is important because adaptive management in a changing climate requires planning for multiple possible futures (Weeks, Malone, & Welling, 2011), and this study explored one “possible” (and likely) future at KEFJ.

Management Responses to Climate Change

Part of planning for possible futures involves assessing comparable management scenarios and, similar to Exit Glacier at KEFJ, the Franz Josef Glacier in New Zealand provides many recreation opportunities, including walks on the glacier, helicopter-assisted walks, and ice climbing (Purdie, 2013). The Franz Josef Glacier is located within Mount Cook National Park (New Zealand), and this park is also facing glacial retreat. Moraine walls are unstable and access to glaciers is becoming increasingly dangerous and difficult for visitors to navigate (Purdie, 2013). Glacier walks were held at Mount Cook in the past, however it has become too unsafe and the access is no longer available (Purdie, 2013). There is a new recreation opportunity, however, provided at the lake below, which the glacier created. There have been increased boat and sea kayak trips on the lake as well as many winter adventure opportunities (Purdie, 2013). Due to the unsafe conditions in some areas of the glacier, the helicopter-assisted walks are an adaptive strategy companies are using to bring visitors to glaciers. Managers also track and regularly modify viewing areas for the glaciers (Purdie, 2013).

Another example provided by Archie and co-workers (2012) identified how U.S. federal land managers are adapting to climate change. Archie and co-workers (2012) discovered that according to managers there are many barriers to implementing adaptive management strategies, including lack of information at relevant scales, budget constraints, lack of specific agency direction, and lack of useful information. The study demonstrated that agencies reported different levels of using adaptive strategies and different major hurdles for implementation (Archie et al., 2012). Similarly this current study helped inform managers of how visitors perceive the retreat of Exit Glacier, and it

also aimed to provide insights into possible management strategies for the future by investigating visitor preferences for management action.

Normative Approach

In order to understand when visitors find possible glacial retreat conditions influential, the Normative Approach was adopted for this study. The Normative Approach suggests visitors to protected areas may have shared beliefs about important aspects of their experiences—Including an area's resources—and standards for what constitutes acceptable or unacceptable conditions (Manning, 2011). Researchers and managers refer to these shared beliefs as "norms" (Shelby, Graefe, & Heberlein, 1986). Understanding what visitors deem as acceptable social and ecological conditions can help land managers identify standards of use for a given location (Manning, 2011), which can be judged against objective markers (e.g., use levels, soil loss).

Norms for physical, social, and managerial conditions create indicators and standards. An indicator is a "measurable manageable variable that helps define the quality of a recreation experience. A standard of quality is the minimum acceptable condition of indicator variables." (Manning, 2011, p.137). For example, an indicator that has been used in crowding studies is 'number of people encountered on a trail at one time' with an associated standard, such as '10 people at one time.' However, normative research also often uses "evaluative dimensions" other than 'acceptability' (Manning, 2007) to determine potential standards. For example, respondents might also be asked to report a norm based on the conditions they would prefer to experience, the conditions they think

managers should maintain, and the conditions that are so bad that they would no longer visit the area (i.e., displacement).

Normative methods have helped formulate standards for the number of snorkelers to the Great Barrier Reef (Inglis, Johnson, Ponte, 1999); encounters among snorkelers, divers, and boats at coral reef sites in the Florida Keys (Loomis, Anderson, Hawkins, and Paterson, 2008); visitors and frequency of ferry service to Boston Harbor Islands (Manning, Leung, and Budruk, 2005); vehicles driving on the beach at Cape Cod National Seashore (Hallo & Manning, 2009); and coastal scenic roads and attraction sites at Acadia National Park (Hallo & Manning, 2009).

Although the Normative Approach with indicators and standards is often used in park management studies (Manning, 2011), it has seen less attention in studies evaluating the human dimensions of climate change. Specifically, glacial retreat norms may play a role in helping understand the difference between the actual level of glacial retreat (e.g., biophysical objective data) and the influence of the retreat on the visitor experience and visitor perceptions of retreat (e.g., social subjective data); however, the Normative Approach has not been applied to a study in a national park with the intent to identify visitors' standards related to glacial recession. Conducting this research at Exit Glacier was an attempt to evaluate the efficacy of the Normative Approach in climate change research by identifying what levels of possible glacial retreat are most likely to influence visitors and at what point glacial retreat conditions become "unacceptable" in the context of a national park visit.

Visual Methods

Visual methods are often used with the Normative Approach to understand visitors' evaluations of specific conditions, and computer-altered photographs depicting a range of conditions are often employed. Visual methods are a logical approach because the use of a photograph can provide a depth of understanding for environmental conditions where words and numbers are insufficient (Banks, 2001). Visual methods are also flexible because they can represent actual existing conditions or future projected conditions (Hull & Stewart, 1992; Lee & Shelby, 2003; Manning, Lime, Freimund, & Pitt, 1996; Manning & Freimund, 2004). As a result, computer-altered photographs can help visitors "see" a range of scenarios, including those that do not yet exist (Banks, 2001). The pictures do not replace real conditions; however, they can assist in visitors understanding change and their possible perception of different conditions (Laven, Manning, & Krymkowski, 2003). Often a social norm curve is created from average evaluations of the photographs, which displays visitors' acceptability levels for specific conditions.

Research has shown that photographic measurements are dependable and lasting (Hull et al., 1992). There have been many positive results from using visual methods including computer-altered photographs because they can help managers identify standards of quality (Manning & Freimund, 2004). Ultimately, visual methods are a way to reach visitors cognitively and a way to express a fuller experience for visitors (Hall & Roggenbuck, 2001, p. 327). Not only are visual methods effective, they also have the ability to depict complex issues that otherwise prove challenging to convey, particularly related to climate change (Brownlee, Powell, & Hallo, 2013).

The literature appears conclusive that changes in climate have influenced behaviors, experiences, preferences, and management action (Baron et al., 2009; Hall & Farge, 2003; Li., K., et al., 2001; Morton, 2007; Oppenheimer, 2012; Orlove, 2010; Richardson & Loomis, 2004; Scott, et al., 2006; Tacoli, 2009). However, the literature also indicates that limited studies have investigated how future projected recession of an iconic glacier may influence the visitor experience. Furthermore, the Normative Approach and visual methods appear appropriate to evaluate visitors' responses to future conditions, and are therefore used in this study.

Research Questions

As a result of the literature and Park managers' needs to understand possible futures and effectively allocate their resources, the following research questions were constructed. The specific research questions below stemmed from the overall question, "How may possible glacial recession (e.g., decreased volume, retracting terminus location) of an iconic park glacier (e.g., Exit Glacier) influence the visitor experience, visitor behavior, and visitor preferences?"

1. On average, at what level of possible glacial retreat (e.g., decrease in Exit Glacier volume and terminus location) and decreased proximity (e.g., access or ability to get close to Exit Glacier) do visitors report:

   a. That glacial conditions become unacceptable;

   b. Decreased or increased desire to visit the glacier;

   c. Potential decreased or increased length of stay in the glacier area; and

   d. High potential for intrasite (e.g., another area of KEFJ) or intersite (e.g., to

another AK park) displacement?

2. How do visitors' beliefs in climate change influence their responses to the previous questions (1a-1d)?
3. What thoughts and feelings do visitors express at different levels of possible recession?
4. If the glacier continues to retreat, what alternative experiences at Exit Glacier do visitors prefer (e.g., increased interpretation, glacier videos, audio of soundscapes)?

Methods

Research Location

Kenai Fjords National Park (KEFJ) was created in 1980 and is currently managed by the National Park Service (NPS). KEFJ is located in south central Alaska on the Kenai Peninsula and covers approximately 670,000 acres, including the Harding Icefield, which has 40 outlet glaciers. Stretching approximately 300 square miles, the Harding Icefield is the largest icefield in the Kenai Mountains (Spencer & Irvine, 2005). Each year the Park receives approximately 290,000 visitors, who have the opportunity to view and hike close to terrestrial glaciers as well as experience tidewater glaciers via boat tours (Brownlee et al., 2013). Visitors can enjoy marine life in their habitat and the fjord ecosystem. While providing this experience to visitors, the Park also works to preserve the scenic beauty and the environmental integrity of the Harding Icefield. KEFJ also provides learning opportunities and an ideal location for understanding ecosystem changes and the impacts of climate change (KEFJ, 2009). There is currently a visitor center which provides excellent hands on learning for visitors to increase awareness of climate change. There are educated rangers to help with interpretation.

Over the last six decades Alaska has had an average annual temperature increase of 2.0°C (ACIA, 2004). Due to the increase in temperature, 98% of Alaska's glaciers are retreating and thinning (Molina, 2007). Between the years of 1950 and 1990, the Harding Icefield in KEFJ has decreased by 34km^3 and lost 21 meters in elevation (Arendt, Echelmeyer, Harrison, Lingle, & Valentine, 2002). It is estimated that the rate of thinning increased one and a half times between the mid-nineties and 1999 (Vanlooy, 2006). Between 1950 and 2000 the terrestrial terminus of Exit Glacier thinned by 90 meters and retreated 500 meters (Aoalgeirsdottir et al., 1998). There have been shrubs expanding into higher elevation, which is encouraged by higher temperatures and glacial recession (Jorgenson & Bennot, 2006). Figure 1 displays a map of Kenai Fjords National Park.

Computer-Altered Photographs

To address the research questions using the Normative Approach, researchers administered onsite questionnaires to KEFJ visitors. Similar to other park-based visual method studies, the first portion of the questionnaire consisted of a series of questions related to the computer-altered photos of Exit Glacier. As recommended in visual methods, participants viewed all of the photos contained in a binder at one time, in random order (Gibson, Newman, Lawson, Fristrup, Benfield, Bell, & Nurse, 2014). A glacier expert from Kenai Fjords was consulted to gain insight into current and projected conditions, and the rate of past recession for Exit Glacier, particularly the last 10 years, was used as a basis for developing the hypothetical conditions represented in the photographs.

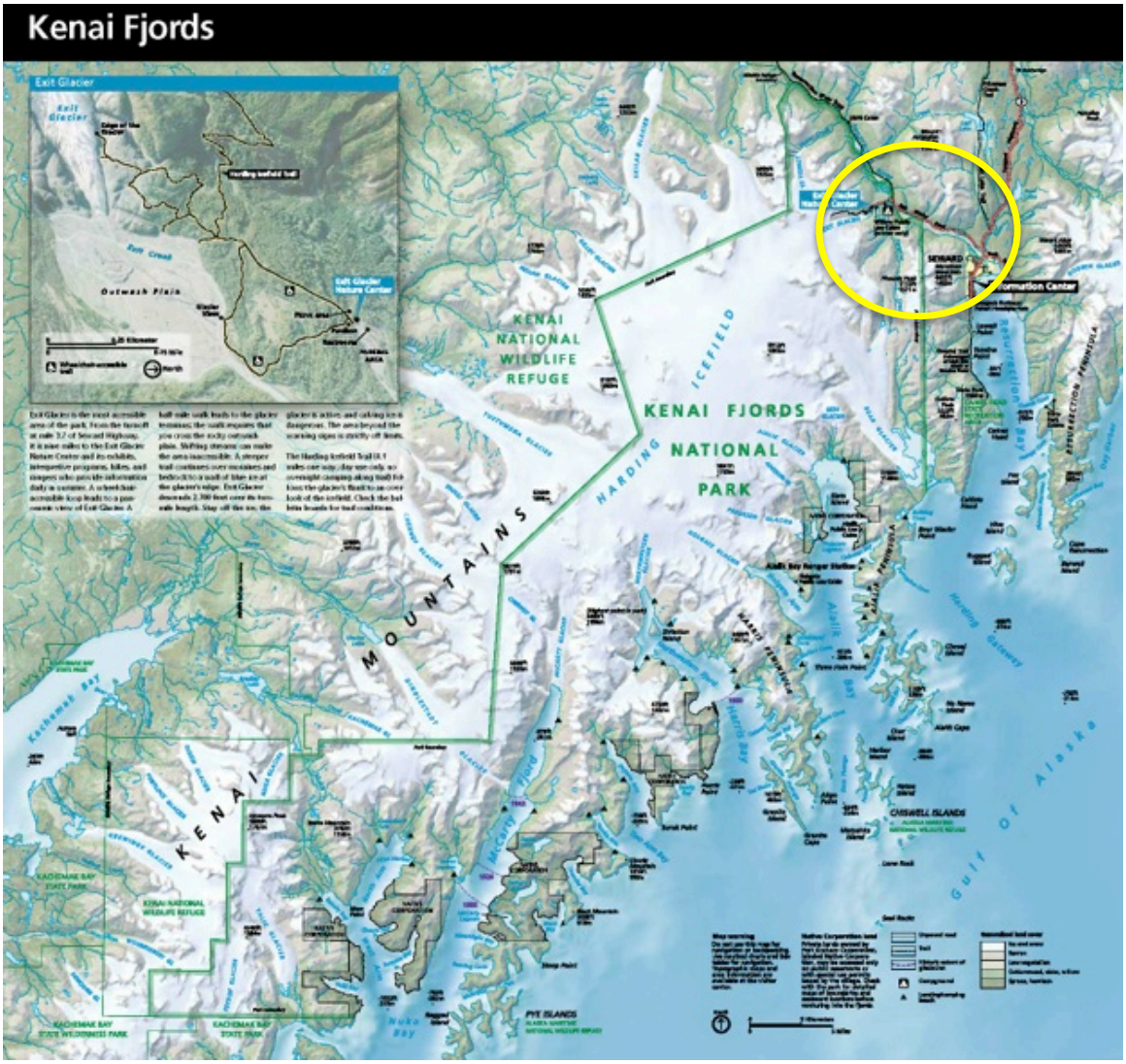

Figure 1. Map of Kenai Fjords National Park (NPS website)

It is important to note that projecting the recession of any glacier is influenced by highly correlated and often unknown factors, such as future temperature and precipitation projections, accumulation activity, glacier geometry, glacier-climate response time, and sub glacier topography. Therefore, the recession photos were intended to be possible projections capturing *one* of many possible futures of Exit Glacier.[1] There were two sets of photographs, each matched with the same questionnaire. The first photo set provided a view of Exit Glacier from a highly visited viewing location (e.g., the outwash plain) and the second photo set displayed conditions approaching the glacier from the upper portion of the Exit Glacier trail and depicted how visitor proximity to the glacier may change over time.

Sampling and Questionnaire

A random probability sampling approach was used in order to gather an appropriate representation of the KEFJ summer visitors (Vaske, 2008). Park visitors were intercepted near the Exit Glacier Visitor Center for three weeks in late July during different times of the day and days of the week. A questionnaire was paired with two different sets of computer-altered photos contained in separate binders. One photo set binder displayed Exit Glacier's overall retreat (Figure 2) and the other photo set binder displayed decreased proximity (Figure 3). To decrease response burden, visitors completed only one questionnaire and reviewed only one photo binder. Visitors were informed that the photographs represent hypothetical future conditions and did not display known or inevitable conditions.

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[1] Even those with the most expertise in KEFJ's glaciers cannot confidently associate a specific year with any particular photograph.

Overall Recession Photo Series

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Figure 2. Overall Recession Photo Series

Proximity Photo Series

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Figure 3. Proximity Photo Series

During questionnaire completion, participants rated the acceptability of the conditions displayed in the photos using a nine-point scale (- 4 for "very unacceptable" and + 4 for "very acceptable," with a midpoint of zero). The questionnaire also consisted of questions related to visitors' preference for management actions and visitor possible behaviors (e.g., displacement) based on photo conditions. Participants answered one open-ended question related to one photo (randomized per participant) asking them to identify their thoughts and feelings regarding the overall recession or decreased proximity of Exit Glacier. All of the content of the questionnaire was created using standard metrics and procedures (e.g., Brownlee & Verbos, 2015; Hallo et al., 2013; Manning, 2007), and with consultation from key KEFJ staff.

Additionally, the questionnaire included a 14-item validated scale (the OC-AN scale) to evaluate how visitors' perception of climate change may influence their responses to photo conditions. Specifically, the OC-AN measures the two primary dimensions of climate change beliefs: (1) Occurrence (OC; belief that climate change is currently happening), and (2) Anthropogenic Causation (AN; belief that climate change is caused by humans). The scale has exhibited high convergent, content, and predictive validity, and appropriate metric invariance across settings and populations (for testing see Brownlee & Verbos, 2015).

Analysis

Regarding the quantitative survey data, a multistep process was used to address the research questions. First, responses from the survey questionnaires were entered into SPSS 18.0 Statistical Software Package and standard calculations for leverage, kurtosis, and

skewness were used to identify statistical outliers and to verify univariate and multivariate normality of the data (Tabachnick & Fidell, 2001). Second, fit indices, factor loadings, measurement variance, item independence, and divergent validity of the OC-AN scale were evaluated using Confirmatory Factor Analysis (CFA; Byrne 2008). Third, most research questions were evaluated using social norm curves, descriptive statistics, cross tabulations, and means testing. The Potential for Conflict Index (PCI^2; Vaske, Beaman, Barreto, & Shelby, 2010) was used to assess norm crystallization, or in this case the level of visitors' agreement regarding the evaluation of a photograph. The PCI^2 ranges from 0 (minimal) to 1 (maximum agreement) and is used to describe a variable's central tendency and dispersion using a graphic display. Fourth, using the OC-AN scale, a structural regression model (SRM) was used to evaluate the influence of climate change beliefs on visitors' evaluation of glacial conditions in the photographs.

Standard coding procedures (Saldana, 2013) were used during the analysis of the response to the open-ended question about thoughts and feelings. Specifically, a collaborative reading and synthesis of the codes was used to generate themes for responses for each of the five photographs. Next, the codes were thematically grouped to emphasize significant thoughts and feelings that participants communicated for a specific photograph. Finally, the themes were compared across photographs to identify similarities and differences in themes (e.g., participants' thoughts and feelings about conditions). Trustworthiness of the research was increased through consistent coding procedures and the researcher's on-site experience of sampling (Krefting, 1991).

Results

Description of the Sample

During sampling 643 visitors were approached, and 539 visitors completed the questionnaire, yielding a response rate of 86% (4.22% confidence interval at the 95% confidence level). Of the two photo series, 276 visitors (51.4% of the overall sample; 5.89% C.I.) completed the questionnaire while viewing the overall recession photo series, and 261 visitors (48.6%; 6.06 C.I.) completed the questionnaire while viewing the proximity photo series.

The majority of respondents (94%) reported residing in the United States (including 14% from Alaska). Visitors indicated living in a range of U.S. states, resulting in an even distribution across states and the five U.S. Census Regions. The sample was evenly split between males (47.7%) and females (52.1%), with limited differences in respect to race (white visitors comprised 89.7% of the sample). The majority of the sample was well educated, with 71.8% possessing at least a 4-year college degree. However, income was more evenly distributed, with 57.7% of the visitors reporting more than $75,000 in household income annually (not adjusted by census region or state). Most of the sample (76%) reported it was their first visit to the park and 92.4% of visitors reported it was their first visit to the park within the last year.

Acceptability of Conditions

The level of acceptability for both the proximity photo series and overall recession photo series revealed similar social norm curves, which are displayed in

Figure 4 (Proximity) and Figure 5 (Overall Recession). The first photo in the proximity photo series, representing current conditions, received a mean of 2.01 (moderately acceptable conditions), and the first photo in the overall recession photo series received a mean result of 2.19. This result suggests that even current conditions may contain setting attributes that are not necessarily highly acceptable to all KEFJ visitors. The largest difference between the proximity photo results and the overall recession results in regard to acceptability was in Photo 2 . The mean score of Photo 2 in the overall recession photo panel was 1.36, with the proximity photo receiving a mean of only .71.

Regarding the proximity photo series, visitors reported that glacier conditions would become unacceptable between Photos 2 and 3. However, when viewing the overall recession photo series, visitors report that glacier conditions become unacceptable between Photos 3 and 4, suggesting that visitors may interpret decreases in proximity as more influential on the quality of their visit than overall recession. In other words, visitors may have a higher level of tolerance for overall recession as opposed to a loss in proximity.

The shape of the social norm curves for both proximity and overall recession reveal two important points. First, both curves for each photo series are relatively flat, indicating that the norm for unacceptable Exit Glacier conditions may not be well formed. Manning (2007) indicates that evaluating the amplitude of the curve and the distance above and below the neutral point on the norm evaluation scale is one indicator of norm intensity or norm salience. It appears that for KEFJ visitors, the norm salience or intensity might be moderate, as indicated by the relatively flat social norm curves displayed in Figures 4 and 5. This finding is logical since visitors were asked to

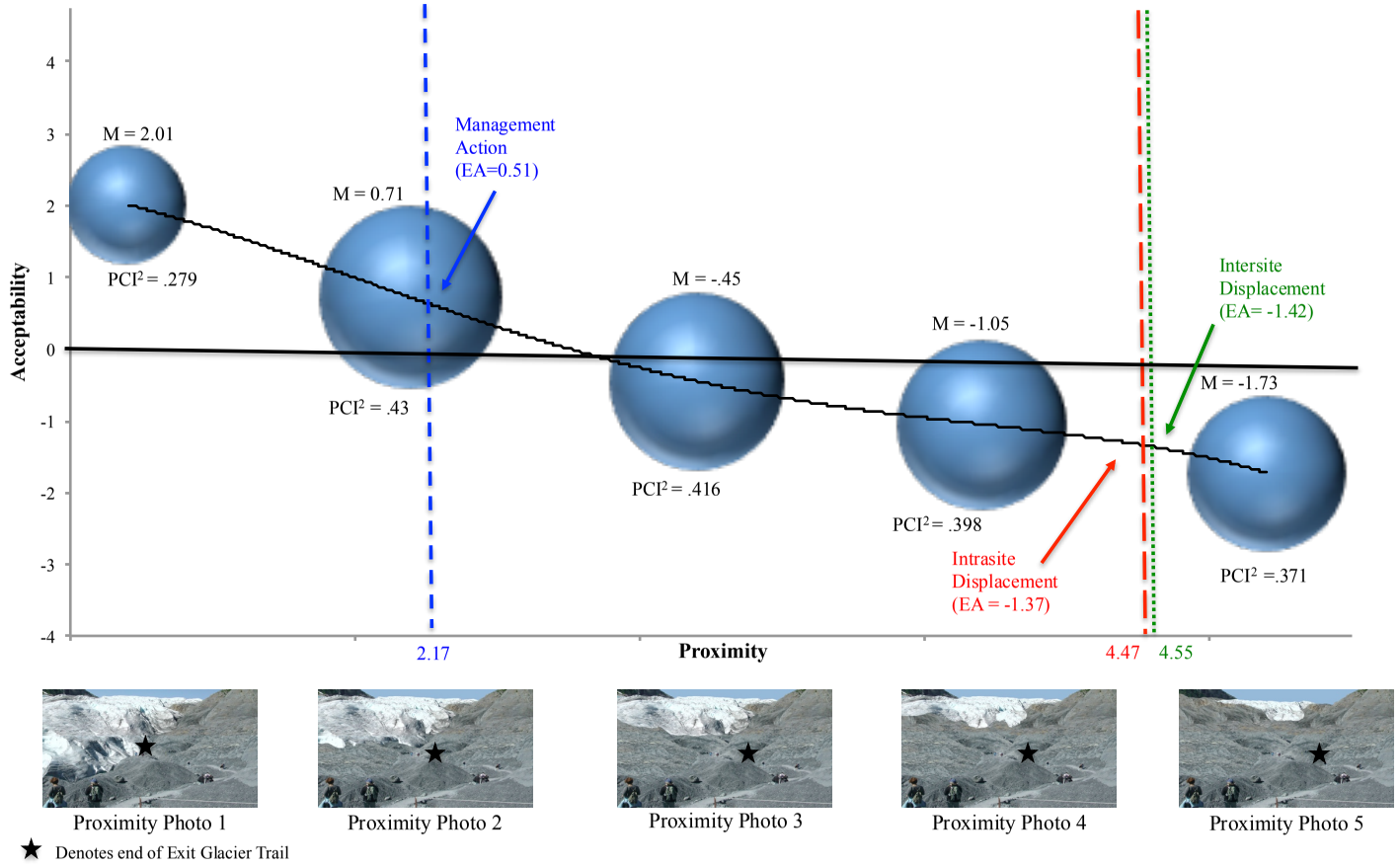


Figure 4. Social norm curve for proximity to Exit Glacier acceptability.
EA=estimated acceptability of condition based on ratio relationships

Note. Visitors viewed the series of photos related to proximity and responded to the question, "While reviewing each Exit Glacier photograph, please circle the number that indicates the level of acceptability of the glacial conditions"; -4 = 'Very Unacceptable'; +4 = 'Very Acceptable.' The size of the ball denotes the norm crystallization (PCI^2), or in this case the level of visitors' agreement regarding the evaluation of a photograph. The PCI^2 ranges from 0 (minimal) to 1 (maximum) agreement.

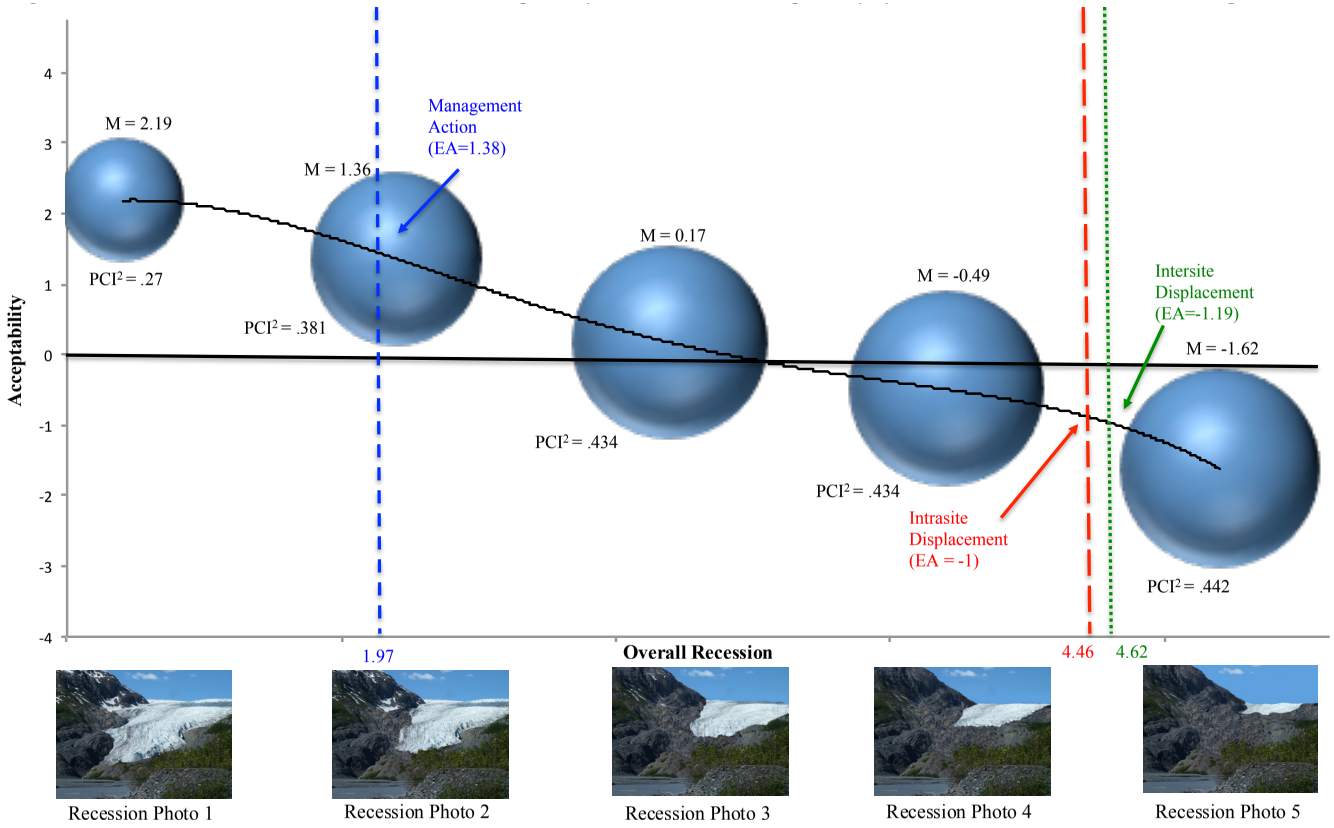


Figure 5. Social norm curve for proximity to Exit Glacier acceptability.
EA=estimated acceptability of condition based on ratio relationships

Note. Visitors viewed the series of photos related to proximity and responded to the question, "While reviewing each Exit Glacier photograph, please circle the number that indicates the level of acceptability of the glacial conditions"; -4 = 'Very Unacceptable'; +4 = 'Very Acceptable.' The size of the ball denotes the norm crystallization (PCI^2), or in this case the level of visitors' agreement regarding the evaluation of a photograph. The PCI^2 ranges from 0 (minimal) to 1 (maximum) agreement.

evaluate acceptability levels of future conditions with a resource (e.g., iconic glacier) with which they had limited interaction or no baseline for judgment. Generally, if norms for an ecological or social condition are not well established within a population, social norm curves may appear relatively flat compared to well-established norms with high norm intensity (Manning, 2007).

Visitors' level of agreement for the norms was fairly consistent between both photo series, ranging from PCI^2 levels of 0.27 (moderate agreement) to 0.44 (moderate disagreement). This level of agreement is referred to as norm crystallization or the amount of consensus about the norm (Manning, 2007). This finding indicates that generally KEFJ visitors agree on the acceptability levels of each photograph with moderate levels of norm crystallization present.

Displacement

As demonstrated in Figure 4 and 5, results indicate that possible inter- and intrasite displacement may occur between Photo 4 and 5 for both overall recession and proximity. However, 67% (intersite) and 83% (intrasite) of respondents viewing the proximity photo series and 51% (intersite) and 77% (intrasite) of those viewing the overall recession photo series reported that they would not be displaced as a result of any of glacial condition. The data also suggests that, on average, visitors do not hold drastically different views regarding glacial conditions that would lead to intrasite and intersite displacement, since both appeared relatively close to each other in the norm curves.

Preferred Management Alternatives

As displayed in Figure 4 and 5, Photo 2 in both the proximity and overall recession photo series is where most respondents identified that management action should take place. Overall visitors indicated that the most preferred hypothetical management action was increased viewing locations, and the second most preferred management action was increased interpretation (see Table 1). The means that all management actions were above 4 on a scale of 1-7, suggesting that visitors may prefer all of the management actions suggested.

Desire to Visit and Length of Stay at Exit Glacier

Visitors reported that their desire to visit Exit Glacier would increase for conditions similar to current conditions for the majority of respondents for both proximity (67%) and overall recession (59%; see Table 2). The majority of respondents reported that their desire to visit would decrease as a result of conditions displayed in Photo 5 for both proximity (60%) and overall recession (60%).

The change in length of stay at the Exit Glacier area displayed similar results. Most visitors (55% proximity photo series; 50% overall recession photo series) indicated that they would spend more time at the Exit Glacier area in Photo 1. Similarly, most visitors (47% proximity photo series; 50% overall recession photo series) reported that they would spend less time at Exit Glacier area if glacier conditions resembled Photo 5. A larger amount of visitors reported that ‘none of the conditions’ displayed in the photographs would cause them to spend less time (33% for overall recession and 36% for proximity) or more time (36% for overall recession and 31% for proximity) in the Exit Glacier Area.

Table 1. Visitors' preferences for hypothetical management actions in responses to possible recession

Hypothetical Management Action	Mean	Standard Deviation	Do not prefer at all	← Percentage of Visitors →					Highly Prefer
			1	2	3	4	5	6	7
Increased Viewing Locations	5.2	1.8	6%	5%	6%	15%	14%	19%	35%
Increased Interpretation	4.8	1.7	5%	6%	8%	20%	23%	18%	19%
Binoculars	4.7	2.1	13%	7%	7%	15%	14%	19%	26%
Glacier Videos	4.6	1.8	8%	7%	11%	20%	19%	18%	18%
Audio of Glaciers	4.3	2.0	13%	8%	13%	15%	18%	15%	17%

Note. Visitors responded to "While the future conditions of Exit Glacier is uncertain, we would like to know your preferences for potential management actions in the Exit Glacier Area if Exit Glacier continues to retreat. The management actions are hypothetical and may not be implemented by Kenai Fjords National Park." 1 = 'do not prefer'; 7 = 'highly prefer'.

Table 2. Visitors' desire to visit Exit Glacier and potential length of stay across differing levels of possible recession

	None		Photo1		Photo 2		Photo 3		Photo 4		Photo 5	
			Current Condition		←					→	Extreme Recession	
	Proximity	Recession	Proximity	Recession	Proximity	Recession	Proximity	Recession	Proximity	Recession	Proximity	Recession
Desire to Visit												
Increase	19%	23%	67%	59%	5%	11%	2%	1%	2%	1%	2%	0.5%
Decrease	23%	27%	3%	1%	4%	0.5%	2%	3%	6%	6%	60%	60%
Length of Stay												
More Time	33%	36%	55%	50%	5%	7%	2%	1%	1%	1%	2%	0.5%
Less Time	36%	31%	2%	2%	4%	1%	3%	4%	5%	6%	47%	50%

Note. Respondents indicated which photo would cause them to change their behaviors based on the questions, "Without any additional management action, which photograph represents glacial conditions that… Your desire to visit Exit Glacier would increase/ decrease? Would cause you to spend more/less time in the Exit Glacier area?" Each question had an option to write down a number of a photo or check the box stating that "None of the photographs display conditions that would increase/decrease my desire to visit Exit Glacier" and, "None of the photographs display conditions that would cause me to spend more time at Exit Glacier."

Thoughts and Feelings Expressed at Different Levels of Possible Recession

Respondents were asked to identify their thoughts and feelings related to one predetermined random photo in their photo binder. The responses were coded into themes. Table 3 represents the most prevalent themes found for each photo. The theme that was most prevalent for Photo 1 was "intimacy" with Exit Glacier. A quote that exemplifies that theme is, "I feel the ability to come up and touch or be face to face with a glacier this size would make me more likely to visit." Other statements referring to intimacy discussed their enjoyment with the ability to be close to the glacier.

"Excitement" and "Awe" were two themes mainly present in Photo 1 and 2, with minimal responses related to excitement and awe in Photo 3 and no responses in Photo 4 and 5. An example of a statement that contained excitement was, "Exciting! Breathtaking," which was a response to Photo 1. Another visitor stated in response to Photo 1, "it's all awesome and alive," which falls in the theme of awe. Another theme that was mostly noted in Photo 1 and 2 was "satisfaction with the conditions" presented in the photo. There were responses that fit into this theme for all photos. In response to Photo 2 a respondent stated, "It would be acceptable for viewing." Satisfaction, excitement, and awe were themes mainly found in Photos 1 and 2.

The theme most prevalent in Photo 2 is "recession." "Seeing a glacier receding like this is depressing especially since this should be an awesome and exciting sight." This comment combined both recession and sadness, which was a trend among responses. Recession was a theme that was noted in all photos; however, it was most prevalent in Photo 2.

Table 3. Visitors' thoughts and feelings related to differing levels of possible recession

	Photo 1 (n=85) Current Condition	Photo 2 (n=92)	Photo 3 (n=92)	Photo 4 (n=80)	Photo 5 (n=84) Extreme Recession
Excitement					
Proximity	20%	2%	1%	0%	0%
View	7%	6%	3%	0%	0%
Awe					
Proximity	4%	8%	3%	0%	0%
View	7%	13%	3%	0%	0%
Intimate					
Proximity	24%	15%	0%	0%	0%
View	7%	2%	0%	0%	0%
Satisfied with Conditions					
Proximity	13%	12%	4%	2%	4%
View	7%	10%	2%	7%	5%
Continue Visiting					
Proximity	9%	7%	10%	11%	9%
View	9%	10%	9%	9%	2%
Climate Change					
Proximity	4%	12%	10%	13%	9%
View	7%	13%	7%	13%	13%
Recession					
Proximity	4%	15%	21%	15%	25%
View	22%	20%	26%	15%	18%
Desire for Proximity					
Proximity	0%	0%	11%	18%	7%
View	0%	0%	3%	9%	2%
Concern for Future					
Proximity	0%	7%	7%	7%	7%
View	0%	6%	12%	13%	16%
Sad					
Proximity	2%	12%	13%	16%	25%
View	7%	8%	14%	15%	29%

Note. Visitors' responses to the question, "Please spend time viewing photograph number ____. Imagine if the conditions in photo ____ were present today. Please list your feelings and thoughts about the conditions and any influence on your visit." Visitor responses were coded for themes and the above chart displays the major themes found present in responses

A quote that best illustrates the theme of "climate change," which was most prevalent for Photo 4, is, "I would be sad but I accept that global climate change is happening and can only hope that we collectively wake and change our behaviors to slow things down." This quote also contains the theme of sadness. Sadness was most prevalent in Photo 5, and a quote that demonstrates this is, "It's sad that the glacier is decreasing." For the theme of sadness there were many simple responses with one to three words containing the word sad. A trend took place of a shift in responses from satisfaction in photos with less recession to sadness and worry with photos of increased recession.

When responding to the proximity photos, an increased amount of respondents indicated intimacy with the glacier for Photo 1 and 2 and desire for proximity in Photos 3, 4, and 5. A quote that demonstrate respondents desire for proximity is, "Disappointed to not be able to get closer; worry about receding ice." In Photos 2 through 5 there were ranges from 6%-16% of responses that were placed in the theme "concern for future." In response to Photo 5, a visitor stated, "sad that glacier is receding, enjoy visit still… hope my grandchildren will get to enjoy this sight."

A theme that was present in all photos was that visitors would "continue visiting," with around 9% in each category and photo stating that they would continue to visit Exit Glacier at the level of recession presented. For example, one of those responses was, "It is still a large glacier that would be worth visiting."

Beliefs in Climate Change Influence on Visitors' Responses and Potential Behaviors

As displayed in Table 4, the measurement performance of the OC-AN Scale was acceptable, evidenced by factor loadings exceeding 0.70 and appropriate levels of model fit (CFI > .9; NNFI > .90; SRMR < .1; RMSEA < .08; Byrne, 2008; Kline, 2011). The model assessing the influence of visitors' beliefs in Occurrence and Anthropogenic Causation on their evaluation of photographs produced acceptable fit (see Table 5; CFI = 0.982; NNFI = 0.977; RMSEA = 0.042; SB χ^2 (df) = 235.52* (135); SRMR = 0.059). On average, visitors reported high beliefs in occurrence (M = 5.61) and anthropogenic causation (M = 5.43; see Table 4), which is similar to previous studies at KEFJ (M = 5.62; 5.61 respectively; Brownlee et al., 2013).

Regarding the influence of visitors' climate change beliefs on their evaluations of potential glacial conditions, the results reveal that as beliefs in the occurrence and anthropogenic causation of climate change increase, the reported acceptability of glacial recession decreases (see Table 5). This relationship is most pronounced for Photos 3-4. However, notable in these relationships is the limited variance in photo acceptability that was explained by climate change beliefs (all partial $R^2 \leq 0.09$), suggesting that numerous factors other than beliefs in climate change influence visitors' acceptability of glacial recession.

Even though levels of acceptability of photographs were influenced by beliefs in climate change, respondents increased or decreased desire to visit exit glacier was not influenced by their belief in climate change ($p > 0.05$). Similarly, visitors' potential increases or decreases in their potential length of stay was also not influenced by beliefs in climate change ($p > 0.05$).

Table 4. Factor loadings, means, standard deviations, and reliability of beliefs in the occurrence of climate change and beliefs in the anthropogenic causation of climate change

Construct and items[a]	**λ**	**Mean**[a] ***(SD)***
Belief in the occurrence of climate change (Occurrence)		5.61
"On average around the earth, I believe the following are happening"		(1.27)[b]
The temperature of the ocean is increasing	0.83	5.51 (1.60)
The areas affected by drought are increasing	0.80	5.66 (1.50)
Air temperature is increasing	0.81	5.54 (1.50)
Permanently frozen snow in the arctic is now thawing	0.89	5.88 (1.32)
Mountain environments are losing snow	0.90	5.80 (1.37)
The number of flooding events are increasing	0.87	5.43 (1.56)
Sea level is rising	0.81	5.42 (1.60)
The amount of ocean ice is decreasing	0.81	5.68 (1.52)
Belief in anthropogenic causation of climate change (Anthropogenic Causation) "I believe the following contribute to changes in climate around the earth"		5.43 (1.55)[b]
Clear cutting of forests	0.77	5.52 (1.74)
Driving gas powered automobiles	0.92	5.43 (1.75)
Burning fossil fuels, such as oil and coal	0.94	5.61 (1.71)
Airplane travel	0.85	4.99 (1.87)
Pollution from factories	0.85	5.67 (1.59)
Clearing land for human use	0.84	5.62 (1.66)
Standardized covariance between occurrence and anthropogenic causation	0.69	-
Reliability coefficient RHO	0.96	-
Comparative Fit Index (CFI)	0.982	-
Non-Normed Fit Index (NNFI)	0.977	-
Root Mean-Square Error of Approximation (RMSEA)	0.046	-
Standardized Root Mean Square Residual	0.030	-
Satorra-Bentler Scaled Chi-Square (SBχ^2) (degrees of freedom)	142.78 (73)*	-

Note. [a] rated as agreement on a seven point Likert scale (1 = completely disagree, 7 = completely agree); [b] = estimated means at the construct level; λ = standardized factor loading; *SD* = standard deviation. CFI = Comparative Fit Index; *df* = degrees of freedom; NNFI = Non-Normed Fit Index; RMSEA = Root Mean Square Error of Approximation; SB χ^2 = Satorra-Bentler Scaled Chi-Square; *SD* = standard deviation; SRMR = Standardized Root Mean Squared Residual; Reliability coefficient RHO is an adjusted Cronbach's Alpha that accounts for unequal contributions from items; * $p < 0.05$

Table 5. Fit indices and outcomes for the influence of climate change beliefs on normative evaluations of photographs

	Photo				
	1	2	3	4	5
Belief in the occurrence of climate change (Occurrence)					
β (F)	-0.13 (2.69)	-0.14 (3.40*)	-0.21 (9.25**)	-0.19 (11.43**)	-0.18 (11.74**)
Partial R^2	0.02	0.02	0.09	0.08	0.09
Belief in anthropogenic causation of climate change (Anthropogenic Causation)					
β (F)	- 0.02 (1.85)	-0.06 (1.42)	-0.11 (5.89*)	-0.18 (13.45**)	-0.19 (14.05**)
Partial R^2	0.02	0.03	0.05	0.07	0.08
CFI = 0.982; NNFI = 0.977; RMSEA = 0.042; SB χ^2 (df) = 235.52* (135); SRMR = 0.059					

Note. CFI = Comparative Fit Index; *df* = degrees of freedom; NNFI = Non-Normed Fit Index; RMSEA = Root Mean Square Error of Approximation; SB χ^2 = Satorra-Bentler Scaled Chi-Square; *SD* = standard deviation; SRMR = Standardized Root Mean Squared Residual; * $p < 0.05$

Overall, these results suggest that although visitors' beliefs in climate change influence their reported acceptance of potential future glacial conditions (e.g., attitudinal), these same beliefs may not influence their behavior (e.g., length of stay, desire to visit).

Discussion

While multiple studies have included climate change scenarios and been used to make projections about visitors' response to changes in climate, there are limited students investigating how national park visitors may respond to specific changes in climate-sensitive attractions. This research evaluated how visitors' experiences, behaviors, and preferences may change depending on future recession of Exit Glacier at Kenai Fjords National Park (KEFJ). Visitors' beliefs in climate change were evaluated to discover how their beliefs might influence responses to potential changes in a climate-sensitive attraction. This research produced findings that warrant discussion, four of which are presented here.

Method

In the photo series, Photo 1 represented current conditions, and Photo 5 represented extreme recession, with the middle photos in respective order. There was more disagreement in visitor responses surrounding the middle stages of recession (i.e., higher PCI^2 levels for Photos 1, 3, and 4 for both proximity and overall recession photos). This could be an indication of a number of factors, with one reason being confusion among respondents due to the random photo order. Some visitors rated photos that had

greater recession more acceptable than they rated a photo with less recession in the middle photos, however, the rest of their acceptability levels decreased with more recession. This may have been confusion as a result of viewing a receding glacier out of chronological order. Another reason may be that visitors understood the varying levels of recession, however, visitors themselves had varying responses to the middle photographs while more consistent answers were found in Photo 1 and 5. It may be that visitors are more likely to find the best scenario very acceptable and the worst scenario very unacceptable, and they may be less sure of responses for middle levels of recession.

Because glacial recession is a different subject than crowding (in crowding, random photo order is effective; Gibson, et al., 2014; Manning, 2011), further research should be conducted to identify if random or chronological photo order is most effective for studying changes in climate-sensitive resources. Other research methods may lend increasing insight on visitor behaviors and preferences in a changing climate, including interviews and observations. One option for another method would be for visitors to view only one photograph (randomly assigned) and to respond to questions about that particular photo. Another option would be to start the photos with past conditions and move to current conditions.

Visitors were asked to rate their level of "acceptability" in regards to differing levels of recession. During onsite sampling visitors asked many questions about the meaning of the term acceptability in reference to glacial recession and the photographs. A number of visitors were confused about the meaning, asking if "acceptable" referred to acceptability on a global level that glaciers are retreating, or "is our changing climate acceptable?" For future research it would be beneficial to consider different terminology

other than the traditional acceptability language used in other normative studies (e.g., crowding studies). For example, the term "quality experience" or "positive experience" may be worth exploring. Acceptability of glacial recession has many external implications regarding the causes of climate change. Because glacial recession is a global issue causing limitations to access to clean water, farming, and recreation (Li, K., Li, Z., Gao, & Wang, 2011; Oppenheimer, 2012; Tacoli, 2009), it is logical for visitors to consider the recession on a global scale instead of simply their current experience with a glacier in a park.

The Normative Approach was used and provided insight into visitor preferences beyond what could be assumed. For example, it would be easy to assume that at the most extreme photo of recession many visitors would not visit KEFJ, however most visitors (86% proximity and 77% overall recession) reported that they would continue to visit the Park regardless of extreme recession. This displays the importance of the Normative Approach because visitors helped identify that KEFJ may remain attractive even when glacial conditions degrade. One reason visitors may be inclined to continue visiting Exit Glacier even with extreme recession is because of *shifting baselines*. For example, visitors did not experience Exit Glacier in the past (before recession), and therefore, have a different baseline of what is acceptable (Knowlton, & Jackson, 2008). Within this approach there are some limitations, including the Hawthorne effect; visitors may have responded in "socially desirable ways" because they knew their answers were going to be analyzed. Visitors' political or religious beliefs may have influenced their responses to items on the questionnaire.

Behaviors Due to Changing Climate

Results indicate that if displacement occurred from KEFJ or the Exit Glacier area it would be likely to happen when Exit Glacier is in a state of extreme recession (Photo 5). However, most visitors reported they would continue to visit KEFJ regardless of extreme recession. This indicates that Exit Glacier is likely to continue as a main park attraction for visitors for many years, even with moderate recession, and if displacement occurs, it will likely be a small percentage of visitors. These results were derived from visitors viewing photographs of Exit Glacier retreating; other factors, such as crowd levels or increases in travel costs, were not evaluated in the research.

Visitors did indicate that they would change behaviors while in the park based on conditions of glacial recession. There were similarities in responses for visitors' desire to visit Exit Glacier and for change in their length of stay. For both the proximity and overall recession, Photo 1 received high visitor responses for increased desire to visit and increased length of stay. Photo 5 received lower desire to visit and decreased length of stay. Although some visitors indicated they would not change their behaviors with changing conditions, the majority of respondents would change behaviors, at least desires to visit.

Although beliefs in climate change did influence visitors' level of acceptability for glacial recession, it had no effect on changes in behaviors. Other factors that may affect changes in behaviors include economic, social, and environmental factors (e.g., tourist safety; Jarvis, Stoeckl, & Liu, 2016).

Thoughts and Feelings

The question posed to visitors regarding thoughts and feelings at differing levels of recession displayed that many visitors find excitement and awe with current conditions, as well as an appreciation for the ability to be close to Exit Glacier. As the photos display potential increased recession, there is a shift in the themes away from excitement and awe and towards desire to be closer to the glacier, concern for future, and sadness. A theme that was present in all photos was climate change. It is vital to continue to research potential visitor responses to climate-change-sensitive attractions and to use an integrated approach to plan for an uncertain future.

Management Implications

Visitors indicated at Photo 2 that management actions should be taken. Most visitors indicated their management preference would be increased viewing locations, followed by increased interpretation. Visitors also had the opportunity to identify other preferred management alternatives. Some of the responses with the highest frequencies included providing climate change education (19%) and providing additional trails (16%). One of the respondents who indicated a desire for increased climate change education stated, “more information about climate change and make it personal to individuals.” Another respondent stated, “individual attention to what people can do to reduce global warming.”

There are implications from these findings for protected areas with climate-sensitive resources. Important for managers to note is that the timing to change management strategies may be now or within the near future. Some strategies visitors

prefer are more opportunities to see and be close to climate-sensitive attractions. This, combined with the desire for increased interpretation, implies that visitors not only want to see and be close to climate-sensitive attractions, they also want to understand the science behind the attractions' rapid change as well as what they personally could do to mitigate impacts. Because most KEFJ visitors do have strong beliefs that climate change is occurring and do desire increased interpretation, it is an ideal location to increase visitors' awareness of ways to reduce climate change impacts. Because humans do not believe in climate change based on facts alone, and emotion is a large part of belief construction (Brugger, J., Dunbar, Jurt, & Orlove, 2013), discussion around climate change implications at a climate-sensitive attraction may be more likely to evoke change (Brownlee et al., 2013).

Kenai Fjords National Park currently has an action plan for a changing climate, including ways they reduce in-park mitigation behavior. They also currently provide climate change education in visitor centers. In other parks and areas, outdoor managers are responding to climate change in a variety of ways. One extreme management action that has taken place is using artificial snow and ice (geotextile material) to increase snow pack where it has been decreasing, such as at an Alpine glacier ski resort (Olefs & Lehning, 2010). In another case, increasing helicopter tours to visit the Franz Joseph Glacier provided more opportunities for visitors to interact with a receded glacier (Purdie, 2013). These management actions have benefits and disadvantages. For example, there may be increased visitor access; however, there may also be increased disruption to the environment. It is vital for managers to work with tour operators, scientists, and policy

makers to make sound decisions about visitor management, potential futures, and climate-sensitive resources (Brownlee & Leong, 2012).

Conclusion

This research revealed visitors' level of acceptability with current and future conditions of Exit Glacier at Kenai Fjords National Park. It demonstrated that with extreme recession, visitors might change their behaviors. Visitors have a desire to be close to Exit Glacier and to understand the realities and implications of climate change. Future research could refine methods and increase understanding of visitors' potential for behavior change at Exit Glacier. Exit Glacier currently provides a desirable experience for visitors, and according to visitors, this will continue even with moderate recession.

Even though one may assume that with great recession there will be much less visitation, the current visitors to Kenai Fjords National Park provide a different story. Most visitors would continue to visit the park with extreme recession. This does not mean that visitation will not decrease. The people of the future cannot be predicted. It would be worthwhile to conduct research in the visitation levels as well as level of satisfaction with visit as Exit Glacier continues to recede. Future research could also focus on how adaptive strategies are being received by visitors, how many visitors use the viewing areas with binoculars, how many visitors seek out the visitor center looking for climate change education, and the length of time visitors spend reading about climate change.

CHAPTER III

REFLECTIONS ON LEARNING

Introduction

The intention of this section is to review the thesis experience and share the challenges, successes, and discoveries that occurred during the process, as well as any advice for duplication of this study. The 'reflections on learning' section accounts for the entire thesis progression and is intended to be an honest reflection of the process. This section presents the insights gained through all of the successes and failures. The following paragraphs explore what I have learned about research, writing, and myself during the entire thesis process.

Challenges

I faced many challenges during the creation of this thesis. Challenges began at the contemplation stage when my first idea for a thesis was too broad and not attainable, I had to switch my focus from a wide-ranging topic to a topic that was narrow enough to make progress. The topic I ended up using had more support and connections from my committee chair, and was more realistic. Once the project was decided, I did not feel fully invested at many times throughout the process. The first reason I gave myself for lack of investment was that I would not be sure of this idea until the National Park Service

approved my permit to conduct research at KEFJ. Throughout the initial stage of writing the proposal, I worried that the project would not be approved and that my efforts on the proposal were being wasted. Once the permit was approved, I discounted my successes, and began to worry that other logistics such as housing would not be attainable. Throughout the process, I was concerned that the project would be rejected in some form and I would have to do something else. This mindset created a slower work pace because of my hesitance on the project.

Communication with the park was a lengthy process. Not only did it take a long time to obtain photos, housing, and clear direction, but some questions were not able to be answered. I had hoped to be able to attach years to levels of recession of Exit Glacier; however, the glacier expert at KEFJ said there are too many unknowns to be able to accurately place years with levels of recession. Once the photographs were received from the park, it was then a challenge to make the appropriate computer alterations, having little experience in the field of digital alterations.

Trials arose while distributing questionnaires, including having to work through emotions of rejection when a few visitors in a row decline to participate in the research. While sampling, some of the comments visitors made were discouraging, which gave me a skewed perspective about how the results may turn out. In reality, the visitors making comments were a small percentage of people filling out the questionnaire, and visitors' comments were different from the results displayed in the data. It was evident by responses that visitors did not fully read questions on the questionnaire.

Some of the staff did not understand the title of this research because of the term "*possible* recession." They know Exit Glacier is receding. Challenges also arose

surrounding terminology in the questionnaire. The term "acceptability" was used in order to understand if people found the levels of glacial recession acceptable for their experience. That term was used because of its prevalence in crowding research. Glacial recession creates different responses than crowding among visitors. Respondents seem more likely to consider the recession at a global level. It is possible a different term would improve the accuracy of results or if a different approach would be needed in order to gain understanding of peoples' experiences with climate-sensitive attractions at parks and protected areas. There were many challenges, some within and some outside of my control. It was exciting along the way to be able to meet the challenges with a willing attitude to be able to work through them. It was very important to have such great support from my committee chair at every step.

Successes

Although there were many challenges, many successes also occurred during the process. In response to the challenge of obtaining realistic computer-altered photographs of future levels of glacial recession at Exit Glacier, a PhD student volunteered to do the work because of her expertise in the area. The fact that some of the KEFJ staff did not understand the title of the research became better after one-on-one explanations as well as a presentation to managers. The presentation to KEFJ managers was a success because many staff came to the presentation and I was able to explain the research and answer any questions. This allowed the staff to understand why I was standing outside the nature center asking visitors to fill out a 10-15 minute questionnaire. Most of the KEFJ staff were very supportive and willing to work with me, which resulted in positive

relationships and smooth processes while completing sampling. Successes also include being granted the research permit by NPS, being provided housing by KEFJ, and receiving funding for travel from the Global Change and Sustainability Center. The sampling was easier than expected and was collected within the allotted time period. It was a success to be able to get all of the 539 questionnaires handed out and returned, and that the questionnaire traveled home safely and were entered into SPSS statistical package in order to be analyzed to provide data for the thesis. It has been a success to be able to stick with an idea and see it all the way through.

Discoveries

Overall learning from this study includes the major findings of the research. Visitors have the strongest reactions with the photo closest to current conditions (Photo 1) and to the photo with the most extreme recession (Photo 5). There was much conflict between the middle three photos and revision of methods would be warranted for further research in perceptions of climate-sensitive attractions within protected areas. People are likely to consider the global level of glacial recession within their experience of visiting a glacier.

It was evident that visitors did not read many of the instructions. One response that demonstrated this was when visitors were asked to answer what they would do instead if they did not visit KEFJ. Many visitors who indicated that they would not be displaced from KEFJ still answered the question where they would go instead. This indicated that the entire question was not read.

Everything I read and was told before arriving at KEFJ stated that there is not an option to extend the Exit Glacier trail due to unsafe conditions such as steep moraine walls. The trail crew who built and maintain the existing trails believe it is possible to create a trail that can continue to bring visitors close to Exit Glacier. They were able to show me a path and explain the plan of how it would be done. The current trail and its prior extension were expensive endeavors, and continuing the trail would be expensive. The benefits of extending the trail may be worth the cost. In order for a National Park to charge an entrance fee they must have an approved project and budget displaying the need for the fee. There currently exists no entrance fee for visitors at KEFJ. Most visitors that come to the park have large incomes, making a ten-dollar entry fee not a deterrent to visit. KEFJ hikes would still be the cheapest tourist attraction in the town of Seward. Could extending the trail be a project worth creating an entrance fee? Currently only two major trails at KEFJ exist. Many of the visitors identified the desire for more trails. If continuing the Exit Glacier trail is not an option, is creating additional trails something worth investing in?

There were also discoveries formed about my passions and myself. Throughout school I admired the NPS from projects and field trips, and from meeting staff and learning about the mission of the NPS. Excited for my time at KEFJ, I was surprised by my reaction to learning more about the inner workings of the NPS. It was discouraging to hear the superintended talk about all the great ideas she had for managing the park contrasted with the little power she had over implementing those ideas. The fact that her ideas must go through Washington DC before they can be approved and set into action is

discouraging. It seems a challenge for staff to be able to have autonomy and make their own changes and decisions. Autonomy is something I value greatly.

During my time sampling I was in a beautiful location. I was outside with a great view of trees, mountains, and Exit Glacier. When I took breaks I could walk to the creek, the outwash plain, or the glacier. Being outside for an extended period of time brings about a certain feeling of peace and acceptance. It is a great privilege to be able to spend so much time outdoors. I have discovered that I believe in the power of nature. This is a concept that has continued to prove true throughout my entire life. From growing up near the beach and spending every summer day in the sand and the waves, to moving out west for a desire to be in the mountains and on extended rafting trips, to working in the wilderness to going to school to study natural resource management, one thing holds true: There is life and goodness in outdoor experiences. As I conclude my master's degree and have spent time on this thesis, I more fully understand how deep my roots are in a belief that being outside increases my quality of life, and it is likely to increase the quality of life of others.

I have learned that research is exciting when thinking about discovering new truths and being able to be a part of the process of gathering and understanding new information. Throughout that process there are many factors that can skew results. I learned that your results are only as good as your questionnaire. The results are also only as good as your sample; it is vital to approach visitors equally and give the same effort in trying to get visitors to complete the questionnaire. Every step of the research project there is opportunity for error, in the data-entry section as well as in analysis.

Advice

It would be wise for graduate students to begin thinking of ideas for what they want to write a thesis on as soon as they start the graduate program, and to have opportunities to explore different areas. A thesis would be a better experience if what you are researching were a life goal or passion of yours.

If I conducted research in the future I would facilitate a more thorough pilot test. There are many benefits of having more people read and respond to the questionnaire. Conducting a more thorough pilot study would provide an opportunity to find any errors or confusion in the wording of the questionnaire. It is possible that an onsite pilot study at KEFJ would have exposed the confusion with the term 'acceptability' in relation to glacial recession. In the future it would be beneficial to find a term that is more closely related to visitors' current glacial experience. It would have been beneficial to know all the management actions that are already in place at KEFJ. For example, on the questionnaire there was a question asking if visitors would want soundscapes of the glacier in the nature center; however, there are currently soundscapes of glaciers in the nature center.

Some respondents stated that the questionnaire did not apply to them because this would be their only visit and the questionnaire is about the future. To assist in that confusion another question that may have been beneficial in the questionnaire is, "Would you recommend this experience to a friend?" It could either be posed at one level of recession, all levels of recession, or the question could be phrased, "At what photo would you no longer recommend this experience to a friend." This question may apply more directly to visitors because most visitors are only going to visit one time.

As stated in the challenges section, it was evident that respondents did not read the entire question on the questionnaire. Is there a way to create a survey that yields beneficial results yet is less of a burden to visitors? Is there a way to simplify questions so that visitors read the entire question? It seems that it would be helpful to simplify the questions. If there was less wording, more words might actually be read. When a question is long, visitors tend to skip over a lot of the question looking for the main point. Could we write it so that the main point we want them to get out of the question is easily viewed?

The potential for conflict was high in Photos 2, 3, and 4 Because of that, problem solving for future research in regards to respondents' understanding of the photos is warranted. One possible solution might be to have the photos in chronological order of recession to increase understanding among visitors. Some respondents rated Photo 3 with higher acceptability than Photo 2, however, they rated Photo 4 and 5 with lower acceptably. It would make sense if the acceptability levels trended in one direction going from high to low acceptability levels.

The biggest difference between proximity and overall recession was indicated in Photo 2. When comparing recession levels among photos, they are similar to each other in all of the levels of recession except for Photo 2. When placing the proximity Photo 2 next to the overall recession Photo 2, they appear to be differing levels of recession, with the proximity photo appearing to have a greater amount of recession than the overall recession photo. For future research it would be beneficial to ensure the two photo panels match each level of recession as closely as possible in order to have comparable results.

Completing a research project is an intensive undertaking requiring many people in order to incorporate all of the pieces needed to gain understanding of visitors' perceptions of recession at Exit Glacier. It was vital to have help creating the photo edits. It was vital to have help with my time at KEFJ. There are many pieces of the puzzle that can all fall into place. If I had it to do over again I would choose a topic that I had more passion surrounding, possibly related to how spending time in nature increases people's quality of life.

I feel I connect more to working with people and helping to find ways for individuals to improve their quality of life. I believe a great tool that can improve others' lives is nature. Research already exists showing that spending time outdoors can increase productivity. That nature can be restorative. I would want to focus specifically on how spending time outside can decrease stress and anxiety in the lives of women. Another research opportunity could be researching how spending time outside effects relationships. If you spend outside time with your friends will you have more meaningful connections? What kind of outdoor adventures promote the deepest relationships? Can spending time outside increase quality of marriage? There are many facets that can be researched regarding benefits of nature.

This thesis process was full of challenges. Despite the many challenges along the way, the process was worth the learning that was gained. There were many people who helped along the way, sharing knowledge and kindness.

APPENDIX A

CONSENT FORM FOR KENAI FJORDS NATIONAL PARK VISITORS

We are inviting you to participate in a research study titled "Understanding potential visitor responses to the possible retreat of Exit Glacier at Kenai Fjords National Park" conducted by Megan Moser and Dr. Matt Brownlee at the University of Utah. The purpose of this research is to gain a better understanding about how the possible recession of Exit Glacier may affect visitor experience, behavior, and preferences.

Your participation will involve completing an anonymous and voluntary questionnaire and answering questions related to future possible scenarios of the recession of Exit Glacier. The amount of time required for your participation will be approximately 10-15 minutes. No involvement in the research after your completion of the questionnaire will be requested or required.

There are no known benefits to you that would result from your participation in this research. Benefits associated with the results of this study include benefits to manager's at Kenai Fjords National Park being provided with potential visitor responses to one possible future climate scenario, in order to hemp improve planning for the park.

We will do everything we can to protect your privacy. We do not have access to and are not requesting your personal information, such as your name, address, or any other identifiers that would connect you to the study. You were selected to participate in the study by the use of a random sampling technique. Data from the paper questionnaire will be entered into an electronic database and saved in an encrypted file that is only accessible by Megan Moser and Dr. Matt Brownlee.

Your participation in this research study is voluntary. You may choose not to participate and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study.

Contact information

If you have any questions or concerns about this study or if any problems arise, please contact Megan Moser at the University of Utah at (801) 560-4984 or *mcmoser84@gmail.com* OR you can contact Dr. Matthew Brownlee at the University of Utah at 801-585-7239 or at *matthew.brownlee@hsc.utah.edu.*

Contact the Institutional Review Board (IRB) if you have questions regarding your rights as a research participant. Also, contact the IRB if you have questions, complaints or concerns which you do not feel you can discuss with the investigator. The University of Utah IRB may be reached by phone at (801) 581-3655 or by e-mail at *irb@hsc.utah.edu.*

By completing the questionnaire, you are giving your consent to participate. Thank you.

APPENDIX B

RESEARCH PERMIT

SCIENTIFIC RESEARCH AND COLLECTING PERMIT

Grants permission in accordance with the attached general and special conditions

United States Department of the Interior
National Park Service
Kenai Fjords

Study#: KEFJ-00097
Permit#: KEFJ-2015-SCI-0004
Start Date: Jul 22, 2015
Expiration Date: Sep 01, 2015
Coop Agreement#:
Optional Park Code:

Name of principal investigator:
Name: Megan Moser **Phone:**801 560 4984 **Email:**mcmoser84@gmail.com

Name of institution represented:
University of Utah

Co-Investigators:
Name: Matthew Brownlee **Phone:** 801 - 585 - 7239 **Email:** Matthew.Brownlee@hsc.utah.edu

Study Title:
Understanding Visitors' Responses to The Retreat of Exit Glacier

Purpose of study:
Exit Glacier provides an experience for visitors to interact with a glacier due to its proximity to the road. Visitors come from within the United States and also from around the world to experience Exit Glacier and Kenai Fjords National Park (KEFJ). This is a rare opportunity not afforded in many other locations. However, Exit Glacier has been retreating and has decreased in volume and continues to move away from the original trail that led to the glacier. The trail has recently been extended for visitors to be able to continue to reach the end of Exit Glacier.

As Exit Glacier continues to retreat it will become smaller and less accessible for visitors. The purpose of this study is to understand the likely visitor response to the retreat of Exit Glacier. This study hopes to gain an understanding of how Exit Glacier retreat will influence visitor behaviors, experiences, and preferences.

It is vital to understand the visitor response in order to make informed management decisions and provide a positive and high quality experience for visitors.

Subject/Discipline:
Social Science

Locations authorized:
Visitors will be intercepted (using a randomization technique whereevery nth individual is approached) outside the Exit Glacier Nature Center. Intercepted individuals will be asked if they would be willing to participate in an independent voluntary and anonymous survey. Investigators will wear University of Utah clothing, a name tag identifying the university affiliation, and will clearly communicate the independent nature of the research, which is not financially supported by the NPS. Visitors will complete a questionnaire only once, and only one member of a group (e.g., family) will complete the questionnaire. Response rates and identifiers for non-response bias will be recorded.

Transportation method to research site(s):
Access to Exit Glacier will be obtained using buses departing from Seward, AK, and/or private transportation.

Collection of the following specimens or materials, quantities, and any limitations on collecting:

Name of repository for specimens or sample materials if applicable:

Specific conditions or restrictions (also see attached conditions):
Park Specific Conditions for Scientific Research & Collecting Permit

Kenai Fjords National Park

• All researchers must notify Laura Phillips(907-422-0540), Mark Thompson (907-422-0522) or your assigned park liaison when they expect to be in the park. You may leave a message at (907-422-0500).

• While within Kenai Fjords National Park, all food and scented or odorous items must be stored in a manner that is secure from bears and other wildlife. Use of park approved bear-resistant food containers is required of researchers for any overnight travel.

• All camping must utilize minimum impact techniques such as Leave No Trace to protect park resources.

• To prevent the spread of invasive plants into the park, clothing and gear, including boats, camping gear and other equipment, should be free of soil and plant material before entering the park.

• Specific authorization must be obtained before using hazardous materials (including fuels) in Kenai Fjords National Park. Material Data Safety Sheets (MSDS) for the hazardous materials must be provided to park personnel and be in your possession while you are in the park, and any spill of the material must be reported immediately to Sharon Kim (907-422-0546) or Mark Thompson.

• Researchers authorized to collect Natural History specimens for permanent retention must contact the Park Collection Manager (Shannon Kovac 907-422-0541; shannon_kovac@nps.gov) for instructions, via telephone or email, prior to collection of specimens, prior to preparing and submitting catalog data, and prior to submitting specimens and associated records. The researcher will provide the Collection Manager with their contact information.

• All records generated from research conducted on NPS lands including, but not limited to, plans, field notes, field maps, drawings, raw data sheets, tape recordings, photos, photo logs, instrument charts, map overlays, negatives, and remote sensing data (records) are, and remain the property of the NPS. The investigator will contact the Park Collections Manager (Shannon Kovac; 907-422-0541; shannon_kovac@nps.gov) to ensure that these records are properly accessioned. Final disposition of all records will be specified by the NPS in accordance with approved Park policies and procedures.

• All geospatial data, metadata or applications to be delivered to an Alaska Park must be in a format compatible with the Parks current GIS software and must be delivered to the Park on media that are compatible with the Parks current GIS hardware. You need only submit final GIS data layer(s) developed as a result of your research at the Alaska Park.

• The investigator will submit a digital version of products and reports to the research permit coordinator. Reports are defined as information, records, publications or other documentation based wholly or in part on data obtained through the permitted research. In addition, each year the investigator is required to submit to the NPS an Investigator Annual Report (IAR), an on-line report of research activities.

• This permit does not authorize the applicant to enter or conduct activities on private lands within the boundaries of Kenai Fjords National Park. Separate permission to conduct research on private lands must be obtained from the landowner. It is the investigators responsibility to learn the location of these lands and obtain permission prior to entry as much of the coast is privately owned.

Recommended by park staff(name and title): Environmental Protection Specialist

Reviewed by Collections Manager: Yes X No ___

Approved by park official:

Date Approved: 4/7/15

Title:

Superintendent

I Agree To All Conditions And Restrictions Of this Permit As Specified
(Not valid unless signed and dated by the principal investigator)

Megan Moser

(Principal investigator's signature)

5-21-2015

(Date)

THIS PERMIT AND ATTACHED CONDITIONS AND RESTRICTIONS MUST BE CARRIED AT ALL TIMES WHILE CONDUCTING RESEARCH ACTIVITIES IN THE DESIGNATED PARK(S)

APPENDIX C

EXIT GLACIER CONTACT FORM

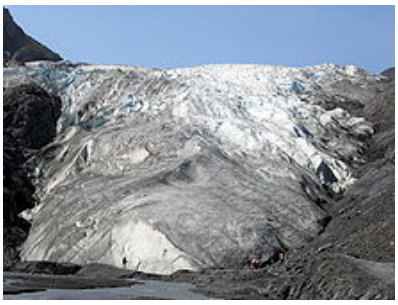
Exit Glacier Contact Form	Date:									
Hello My Name is Megan Moser, I am from the University Of Utah, conducting research about visitor perceptions of future climate scenarious. Some visitors are completing a voluntary and anonymous questionnaire today. Participation is voluntary and your responses will be anonymous. The questionnaire will take about ten to fifteen minutes to complete. Would you be willing to help us today?							If No: OK. Thank you for your time. Have a good day. If "yes": OK. Thank you for agreeing to participate. Here is an informed consent form that we need you to review prior to completing the questionnaire. After reviewing the informed consent sheet, do you have questions about the informed consent sheet? Are you providing your consent to participate in the study? Once Completed: Thank you very much for supporting this research.			
Interval	Time	Accepted Q	Refused Q	Q #	Binder #	Group Type	Group Size	# of Children	# of Adults	Comments
Totals:										

APPENDIX D

VISITOR PERCEPTIONS OF EXIT GLACIER QUESTIONNAIRE

Visitor Responses to Possible Changes at Exit Glacier

Important questions for visitors to Kenai Fjords National Park



The purpose of this study is to understand how Exit Glacier's potential retreat may influence visitor behavior, experiences, and preferences

After you complete this questionnaire, please return it to the field researcher
All responses are confidential
Thank you for your cooperation

Conducted by

Outdoor Recreation, Education, & Tourism Lab
COLLEGE OF HEALTH | THE UNIVERSITY OF UTAH

Researcher use only:

Time _____ **Date** _____ **Binder #** _____

Comments _____

SECTION 1: YOUR VISITS

1. Please tell us about *your past experience* visiting Exit Glacier.

- **a.** Including this visit, approximately how many times in the last year (12 months) have you visited Exit Glacier? _____# of visits in the last year
- **b.** Including this year, how many times (total) have you visited Exit Glacier? _____# of visits total
- **c.** What are the approximate years of your *previous visits* to Kenai Fjords National Park? (For example: 1994, 2005, 2011, etc.)_____

2. Please tell us about *your current visit* at Exit Glacier

- **a.** Approximately how much time in minutes did you spend in the Exit Glacier Area during this visit? _____ minutes
- **b.** During this current visit to the Exit Glacier Area, what activities, events, and experiences were most enjoyable?

_____

_____

SECTION 2: OPINIONS ABOUT EXIT GLACIER

We would like to know your opinions about different hypothetical conditions at Exit Glacier. To judge this, we have a series of hypothetical photographs in the photo binder. **These photographs display hypothetical conditions and are not necessarily an accurate projection of future glacial recession**.

3. While reviewing each Exit Glacier photograph, please circle the number that indicates the level of acceptability of the glacial conditions. A rating of -4 means the glacial conditions displayed in the photograph are 'Very Unacceptable,' and a rating of +4 means the conditions are 'Very Acceptable.' (*circle one number for each photograph using the response categories below*)

	Very Unacceptable	Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither acceptable or unacceptable	Slightly Acceptable	Moderately Acceptable	Acceptable	Very Acceptable
Photo 1	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 2	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 3	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 4	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 5	-4	-3	-2	-1	0	+1	+2	+3	+4

4. Please record the photo number or check the box to answer each of the following questions. **Without any additional management action, which photograph represents glacial conditions that…**

a. Your desire to visit Exit Glacier would increase?

Photo number: _____ OR ☐ None of the photographs display conditions that would increase my desire to visit Exit Glacier

b. Your desire to visit Exit Glacier would decrease?

Photo number: _____ OR ☐ None of the photographs display conditions that would decrease my desire to visit Exit Glacier

c. Would cause you to spend more time in the Exit Glacier area?

Photo number: _____ OR ☐ None of the photographs display conditions that would cause me to spend more time at Exit Glacier

d. Would cause you to spend less time in the Exit Glacier area?

Photo number: _____ OR ☐ None of the photographs display conditions that would cause me to spend less time at Exit Glacier

e. You would no longer visit Exit Glacier but would visit other areas in Kenai Fjords National Park?

Photo number: _____ OR ☐ None of the photographs display conditions that would cause me to not visit Exit Glacier

i. If you did not visit Exit Glacier because of glacial conditions, what other areas of the park would you visit? (check all that apply)

☐ Marine ecosystem by boat tour ☐ National Park Service Visitor Center in the town of Seward ☐ Other _____

f. You would no longer visit Kenai Fjords National Park?

Photo number: _____ OR ☐ None of the photographs display conditions that would cause me to not Kenai Fjords National Park

i. If you did not visit Kenai Fjords National Park because of glacial conditions, what would you do? *(fill in the blank)*

_____

5. Please spend time viewing photograph number _____. Imagine if the conditions in photo _____ were present today. Please list your feelings and thoughts about the conditions and any influence on your visit.

6. Which photograph represents glacial conditions that you think the National Park Service should take additional management action to enhance or change the visitor experience at Exit Glacier?

Photo number: _____ OR ☐ None of the photographs display conditions that warrant management action

7. While the future conditions of Exit Glacier is uncertain, we would like to know your preferences for potential management actions in the Exit Glacier Area if Exit Glacier continues to retreat. The management actions are hypothetical and may not be implemented by Kenai Fjords National Park. Please circle the number that indicates your preference level for the following potential management actions. A rating of 1 means that you 'do not prefer' the potential management action and a rating of 7 means that you 'highly prefer' the potential management action. (*circle one number for each row*)

Potential and hypothetical management actions	Do Not Prefer At All						Highly Prefer
Increased interpretation about glaciers	1	2	3	4	5	6	7
Glacier videos in the Exit Glacier Nature Center	1	2	3	4	5	6	7
Audio depicting sounds of glaciers	1	2	3	4	5	6	7
Increased viewing locations	1	2	3	4	5	6	7
Binoculars at the end of the trail near Exit Glacier	1	2	3	4	5	6	7

What other potential and or hypothetical management action would you prefer?

_____

SECTION 3: YOUR OPINIONS

Please rate your agreement with the following statements. A rating of 1 means that you 'completely disagree' and a rating of 7 means that you 'completely agree.' *(Circle one number for each row)*

8. On average around the earth, I believe the following are happening…	Completely disagree						Completely agree
The temperature of the ocean is increasing	1	2	3	4	5	6	7
The areas affected by drought are increasing	1	2	3	4	5	6	7
Air temperature is increasing	1	2	3	4	5	6	7
Permanently frozen snow in the arctic is now thawing	1	2	3	4	5	6	7
Mountain environments are losing snow	1	2	3	4	5	6	7
The number of flooding events is increasing	1	2	3	4	5	6	7
Sea level is rising	1	2	3	4	5	6	7
The amount of ocean ice is decreasing	1	2	3	4	5	6	7

9. I believe the following contribute to changes in climate around the earth…	Completely disagree ⟷ Completely agree						
Clear cutting of forests	1	2	3	4	5	6	7
Driving gas powered automobiles	1	2	3	4	5	6	7
Burning fossil fuels, such as oil and coal	1	2	3	4	5	6	7
Airplane travel	1	2	3	4	5	6	7
Pollution from factories	1	2	3	4	5	6	7
Clearing land for human use	1	2	3	4	5	6	7

SECTION 4: ABOUT YOU

10. What is your zip code?_____

11. What year were you born?_____

12. What is your gender? *(check one)* ❑ Male ❑ Female ❑ Other _____

13. What is the highest level of school you have completed? *(check one)*

☐ Less than high school
☐ Some high school
☐ High school graduate
☐ Some college
☐ Two-year college graduate
☐ Four-year college graduate
☐ Graduate or professional degree

14. What is your race/ethnicity? *(check all that apply)*

☐ American Indian or Alaska Native
☐ Asian
☐ Black or African American
☐ Hawaiian or Pacific Islander
☐ Hispanic or Latino/Latina
☐ White
☐ Other

15. Which category best describes your total household income in U.S. dollars during 2014 before taxes? *(check one)*

☐ Less than $24,999
☐ $25,000 to $34,999
☐ $35,000 to $49,999
☐ $50,000 to $74,999
☐ $75,000 to $99,999
☐ $100,000 to $149,999
☐ $150,000 to $199,999
☐ $200,000 or more
☐ Do not wish to answer

APPENDIX E

COMPUTER-ALTERED PHOTOGRAPHS


End of Exit Glacier Trail


End of Exit Glacier Trail


End of Exit Glacier Trail


End of Exit Glacier Trail


End of Exit Glacier Trail

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